

# Feature of unresolved transition array emission in water window soft x-ray spectral region from a dual-pulse laser-produced bismuth plasma



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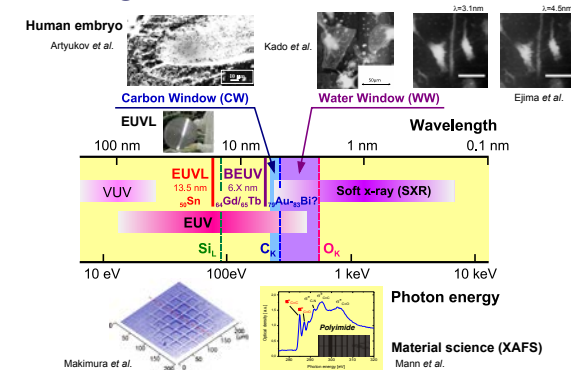
## Abstract

We proposed the use of highly charged ions of Bi plasma as a laboratory scale water window soft x-ray source ( $\lambda = 2.3\text{--}4.4\text{ nm}$ ) for a compact microscope with a single-shot flash imaging capability. We characterize the feature of unresolved transition array (UTA) emission in water window spectral region from a dual-pulse laser-produced bismuth plasma. The optimum separation time between the pre- and main pulses is observed to be around 10 ns. The corresponded total power emitted increases 1.2 times.

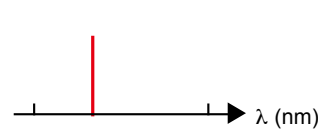
## Summary

- (1) We observed enhancement of the emission energy in water window soft x-ray spectral region dual laser-produced Bi plasmas. The optimum delay time was observed to be 7–10 ns.
- (2) We also observed the absorption spectral structures with the expanding long scale recombination plasmas.
- (3) We evaluated the emissivity and opacity of the highly charged Bi ion plasmas.

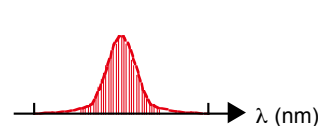
## Background



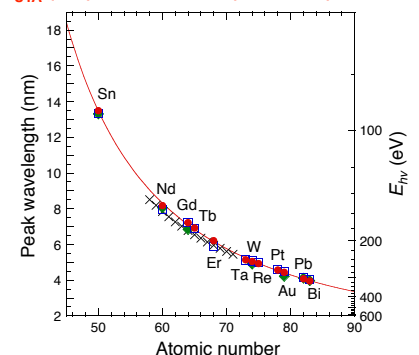
(a) Line spectrum



(b) UTA

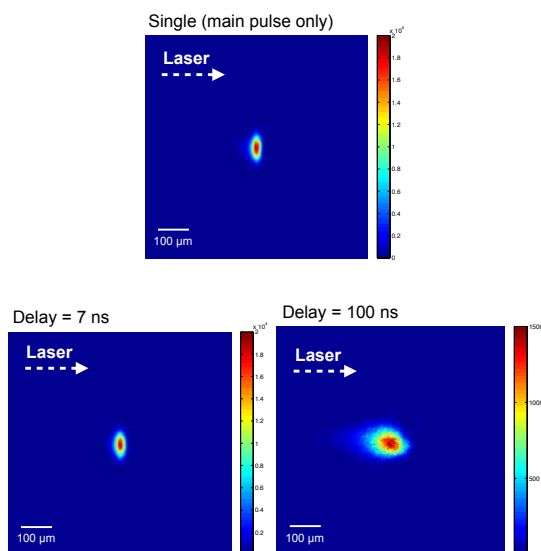


$$\lambda_{\text{UTA}} (\text{nm}) = 21.86 \times R_{\infty}^{-1} (Z - 23.23)^{-1.52}$$

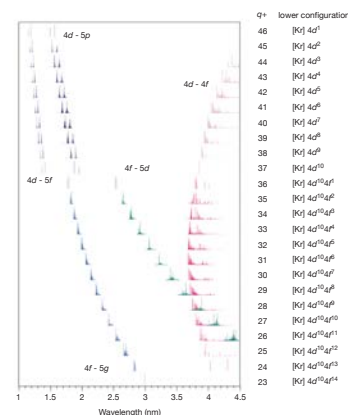
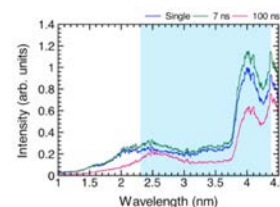


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## Experimental results: pinhole images



## Numerical evaluation



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## Quasi-Moseley's law for strong narrow bandwidth soft x-ray sources containing higher charge-state ions

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